

<b>Name:</b>	<i>Applications of Fire Research</i>
<b>Course Description:</b>	This course examines the rationale for conducting fire research, various fire protection research activities, and research applications, including fire test standards and codes, structural fire safety, automatic detection and suppression, life safety, and firefighter health and safety.
<b>Objectives:</b>	<p><b>Unit 1: Introduction to Fire Research</b></p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• compare the research methodologies of scientific method and systems analysis;</li> <li>• discuss the four steps of a research project;</li> <li>• list five components of a problem definition;</li> <li>• identify three criteria for the validation of research results;</li> <li>• define fire research;</li> <li>• list three objectives of fire research;</li> <li>• identify the goals and programs of the Building and Fire Research Laboratory of the National Institute of Standards and Technology; and</li> <li>• list four sources from which information on fire research is available.</li> </ul> <p><b>Unit 2: Fire Dynamics</b></p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• define fire dynamics;</li> <li>• list two major fields of study that contribute to fire dynamics;</li> <li>• define ignition;</li> <li>• describe the process of air entrainment in a fire plume;</li> <li>• identify the criteria for determining flashover;</li> <li>• define thermal inertia;</li> <li>• list three laws of conservation that are essential to fire dynamics;</li> <li>• list five general areas of research in fire dynamics; and</li> <li>• list two applications of fire dynamics.</li> </ul> <p><b>Unit 3: Fire Safety Properties and Flammability Tests</b></p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• distinguish between intrinsic and extrinsic properties of materials;</li> <li>• define ignitability;</li> <li>• identify three factors that influence ignitability;</li> <li>• list two test methods used to determine ignitability;</li> <li>• define what is meant by a material's flame spread;</li> <li>• list two test methods used to determine flame spread;</li> <li>• describe the use of the oxygen consumption principle in testing for the rate of heat release of a material; and</li> <li>• list three reasons for performing full-scale room fire tests.</li> </ul> <p><b>Unit 4: Fire Test Standards and Codes</b></p> <p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• define fire test standard;</li> <li>• list three uses of fire tests;</li> <li>• compare the standards development processes of ASTM and NFPA;</li> <li>• outline the ASTM ISR (Institute for Standards Research) fire test program.</li> </ul>

<b>Objectives:</b>	<b>Unit 4: Fire Test Standards and Codes (cont'd)</b>
	<ul style="list-style-type: none"> <li>• describe how U.S. standards become international standards;</li> <li>• distinguish between a code and a standard;</li> <li>• define the term "consensus standard";</li> <li>• distinguish between the specification, performance, and systems approaches to code requirements;</li> <li>• list three areas of limitations to building codes; and</li> <li>• list three code study groups.</li> </ul>
	<b>Unit 5: Fire Modeling</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• define the term fire model;</li> <li>• distinguish between physical and symbolic models;</li> <li>• list four benefits of mathematical fire modeling;</li> <li>• distinguish between probabilistic and deterministic modeling;</li> <li>• distinguish between field and zone models;</li> <li>• describe the HAZARD I model, its application and limitations;</li> <li>• list five topics considered in the validation of models; and</li> <li>• describe the dependence of fire modeling research on computer hardware development.</li> </ul>
	<b>Unit 6: Structural Fire Safety</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• list two perceived advantages of ASTM E-119, <i>Standard Method of Fire Tests of Building Construction and Materials</i>;</li> <li>• list three technological disadvantages of ASTM E-119, <i>Standard Method of Fire Tests of Building Construction and Materials</i>;</li> <li>• discuss the trend toward computationally based prediction of structural performance in building fires;</li> <li>• describe three types of research on smoke movement and control;</li> <li>• give three examples of how research on structural efficiency has resulted in decreased fire endurance; and</li> <li>• discuss the need for research on trade-offs between active and passive fire protection.</li> </ul>
	<b>Unit 7: Automatic Detection and Suppression</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• describe two research approaches to the problem of false alarms from fire detectors;</li> <li>• identify two concepts of electronics that have improved the sensitivity and reliability of fire detectors;</li> <li>• define what is meant by very early warning fire detection;</li> <li>• describe the two concepts of sprinkler density upon which current research is based;</li> <li>• discuss the significance of quick response sprinklers in terms of fire development;</li> <li>• give two examples of how environmental protection has stimulated research on fire suppression;</li> </ul>

<b>Objectives:</b>	<b>Unit 7: Automatic Detection and Suppression (cont'd)</b>
	<ul style="list-style-type: none"> <li>list three objectives of research on foam-water sprinklers; and</li> <li>list six approaches to controlling the release of fire protection Halon to the atmosphere.</li> </ul>
	<b>Unit 8: Life Safety</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>identify the three components of life safety;</li> <li>compare the two approaches to testing for smoke toxicity;</li> <li>define toxic potency;</li> <li>identify the two steps in calculating toxic potency;</li> <li>describe the formation of convergence clusters;</li> <li>list the three variables in evacuation time; and</li> <li>list three types of models used in evacuation analysis.</li> </ul>
	<b>Unit 9: Transportation Fire Hazards</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>describe the success of retrofitting hazardous materials tank cars with research-developed safety devices;</li> <li>discuss the use of CAMEO in planning for and reacting to hazardous materials incidents;</li> <li>identify seven major life safety issues involving general mass transportation systems;</li> <li>describe the results of federal research on subway car interiors;</li> <li>identify three areas of federally sponsored research on aircraft transportation fire safety; and</li> <li>describe the shipboard fire engineering methodology used by the United States Coast Guard.</li> </ul>
	<b>Unit 10: Risk Analysis and Loss Control</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>define fire risk;</li> <li>compare four different types of risk;</li> <li>define and discuss the concept of fire risk analysis;</li> <li>summarize the four categories of fire risk analysis methods;</li> <li>describe and discuss the BFRL/NFPRF approach to product fire risk analysis; and</li> <li>identify four strategies in fire risk management.</li> </ul>
	<b>Unit 11: Firefighter Health and Safety</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>list the principal causes of firefighter injuries and fatalities;</li> <li>discuss the potential long-term effects of apparatus warning devices on firefighters;</li> <li>list the critical design features that have been identified through research on firefighter protective clothing;</li> <li>discuss the increasing need for special protective clothing and procedures;</li> <li>list three components of an infection control program amenable to fire research;</li> </ul>

<b>Objectives:</b>	<b>Unit 11: Firefighter Health and Safety (cont'd)</b>
	<ul style="list-style-type: none"> <li>• identify improved design features of breathing apparatus developed under the NASA research program;</li> <li>• identify the sources of emotional and physical stress on firefighters;</li> <li>• discuss the intent and implementation of NFPA 1500; and</li> <li>• explain the use and advantages of a PASS.</li> </ul>
	<b>Unit 12: Fire Service Applied Research</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• identify two alternative organizational entities for providing municipal fire protection;</li> <li>• explain the three barriers to fire service applied research;</li> <li>• list four factors of fire protection effectiveness;</li> <li>• state the most important question in fire service deployment;</li> <li>• give an example of a) a strategic deployment issue, and b) a tactical deployment issue;</li> <li>• identify four research issues in the area of fire department operations; and</li> <li>• list five steps necessary for in-house fire department research.</li> </ul>
	<b>Unit 13: Trends in Fire -Related Research</b>
	<p>After completing this unit, you should be able to:</p> <ul style="list-style-type: none"> <li>• list the controls that are being considered in studies of wildland/urban interface fires;</li> <li>• define the term nonthermal fire damage and explain why it is of major concern;</li> <li>• give examples of research trends in fire dynamics;</li> <li>• identify areas of advancement in mathematical fire modeling as a research tool and as a subject of research;</li> <li>• discuss the arson research project of the National Center for the Analysis of Violent Crime (NCAVC); and</li> <li>• define what is meant by QRA.</li> </ul>
<b>Suggested Text:</b>	<i>Applications of Fire Research Course Guide</i> , National Fire Academy
<b>Supporting References/ Research for Faculty and Students</b>	<p><b>U. S. Fire Administration</b></p> <p>Publications: <a href="http://www.usfa.fema.gov/applications/publications/pubs_main.cfm">http://www.usfa.fema.gov/applications/publications/pubs_main.cfm</a></p> <p>See Fire Protection, Fire Administration, Fire Service Operations, Wildfire Applied Research:</p> <p><a href="http://www.usfa.fema.gov/dhtml/inside-usfa/research.cfm">http://www.usfa.fema.gov/dhtml/inside-usfa/research.cfm</a></p> <p>Research Reports:</p> <p><a href="http://www.usfa.fema.gov/dhtml/inside-usfa/r_reports.cfm">http://www.usfa.fema.gov/dhtml/inside-usfa/r_reports.cfm</a></p> <p>Technical Reports:</p> <p><a href="http://www.usfa.fema.gov/applications/publications/techreps.cfm">http://www.usfa.fema.gov/applications/publications/techreps.cfm</a></p> <p>Topical Fire Research Series:</p> <p><a href="http://www.usfa.fema.gov/dhtml/inside-usfa/tfrs.cfm">http://www.usfa.fema.gov/dhtml/inside-usfa/tfrs.cfm</a></p> <p>Learning Resource Center:</p> <p><a href="http://www.usfa.fema.gov/dhtml/inside-usfa/lrc.cfm">http://www.usfa.fema.gov/dhtml/inside-usfa/lrc.cfm</a></p>

<b>Supporting References/ Research for Faculty and Students</b>	<b>National Institute for Standards and Technology</b> <a href="http://www.fire.nist.gov">http://www.fire.nist.gov</a> : Fire Tests/Data, Software/Models, Publications, FIREDOC (under Publications) <b>References</b> Society of Fire Protection Engineers: <a href="http://www.pentoncmg.com/sfpe/index.html">http://www.pentoncmg.com/sfpe/index.html</a> <b>Current Events/News</b> <a href="http://www.firehouse.com/">http://www.firehouse.com/</a> <a href="http://www.fireengineering.com/">http://www.fireengineering.com/</a> <a href="http://www.withthecommand.com/">http://www.withthecommand.com/</a>	
<b>Assessment:</b>	Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.	
<b>NFPA Standards Addressed:</b>	<b>Unit(s)</b>	<b>Description</b>
1021-2-7.1	11	Apply safety regulations at the unit level
1021-4-5.1	6, 7	Evaluate and identify alarm, detection and suppression features
1021-4-5.2	12	Develop a plan for the approval of a new program
<b>Chief Fire Officer Designation Competencies Addressed:</b>	<a href="http://www.cfainet.org">www.cfainet.org</a> This course provides partial fulfillment of CFOD: Competency #1 Assessment and Planning Competency #10 Health and Risk Management Competency #11 Life Safety	
<b>Point of Contact:</b>	Edward Kaplan, United States Fire Administration (301) 447-1127, <a href="mailto:ed.kaplan@fema.gov">ed.kaplan@fema.gov</a>	

